teletypewriter fundamentals handbook

Teletypewriter Fundamentals Handbook

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Computer Design Publishing Corp.
West Concord, Mass.
First Edition
1965

preface

The purpose of this booklet is to present, under one cover, the basic principles of teletypewriters — how they operate and how they are used. It is written primarily for the benefit of those whose work requires a general knowledge of the devices; whether that work involves a direct association with the machines such as operating and maintaining them, or a less direct association such as an engineer involved with an electronic message switching system.

The booklet's objective, therefore, is not to present a detailed explanation of the theory, design, and operation of teletypewriters. Rather, it is to acquaint the reader, in general terms, with the fundamentals of the machines and some of the ways in which they are used.

table of contents

section		page
1	INTRODUCTION	5
2	TELETYPE SIGNALS	7
3	GENERATION OF SIGNALS	11
4	TRANSMISSION OF SIGNALS	12
5	RECEIVING THE SIGNAL	14
6	TELETYPE DISTORTION	16
7	FSK and RTTY	19
8	VARIETIES OF TELETYPE MACHINES	21
9	GLOSSARY OF TELETYPE TERMS	27

list of illustrations

figure		page
1	Simple Teletype Circuit	5
2	The 7.42 Unit Code Time Base Using the Letter Y	10
3	Transmitter-Distributor	11
4	Half-Duplex Circuit	13
5	Receiving Distributor	15
6	Undistorted and Distorted Impulse	17
7	Teletype Distortion	18
8	Simplified FSK Teletypewriter System	18
9	Simplified RTTY System	20
10	M28 Receive Only Page Printer	23
11	M28 Keyboard Send-Receive Set	23
12	M28 Receive Only Typing Reperforator	24
13	M28 Tape Transmitter	24
14	M28 Automatic Send-Receive Set	24
15	M28 Reperforator Transmitter	25
16	M28 Reperforator Transmitters (Two in One Cabinet)	25
17	M33 Receive Only Page Printer	25
18	M33 Automatic Send-Receive Set	26
19	M35 Keyboard Send-Receive Set	26
20	M35 Automatic Send-Receive Set	26
21	Receive-Only Typing Reperforator	26

section 1 | introduction

A teletypewriter, in a simple analogy, can be thought of as a remotely operated typewriter, the basic function of which is to provide typed copy at an outlying location. However, teletypewriters are much more versatile. They may incorporate features for doing such varied jobs as ringing alarm bells, remotely controlling other apparatus, answering calls, and returning a replying message.

Teletypewriters are connected to each other by circuits which, in their simplest form, consist of a two-wire line and a battery supply, as illustrated in figure 1. The teletypewriter transmitter is represented by a set of switch contacts and the receiver by a relay coil. Basically, this is a true representation. The transmitter causes the circuit to be opened and closed alternately. The resulting current impulses are carried to a relay coil in the receiver and ultimately converted to page copy.

The following sections describe in more detail the make-up of a teletypewriter signal, the manner of generation and transmission, and what happens to it at the receiver. Various types of machines are discussed. A section on signal distortion and a glossary of commonly used teletypewriter terms also are included.

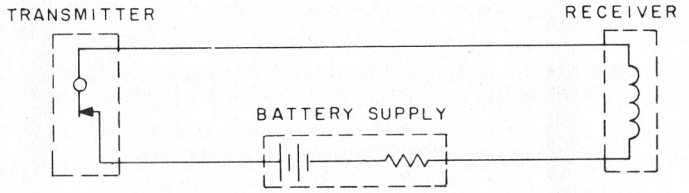


Figure 1. Simple Teletypewriter Circuit

Table 1. Baudot Teletype Code

CHARACTER		IMPULSE POSITION				
Lower Case	Upper Case	1	2	3	4	5
A	-	●	●			
B	?	●			●	●
C	:		●	●	●	
D	$	●			●	
E	3	●				
F	!	●		●	●	
G	&		●		●	●
H	#			●		●
I	8		●	●		
J	'	●	●		●	
K	(	●	●	●	●	
L	)		●			●
M	.			●	●	●
N	,			●	●	
O	9				●	●
P	0		●	●		●
Q	1	●	●	●		●
R	4		●		●	
S	Bell	●		●		
T	5					●
U	7	●	●	●		
V	;		●	●	●	●
W	2	●	●			●
X	/	●		●	●	●
Y	6	●		●		●
Z	''	●				●
Letters (Shift to lower case)		●	●	●	●	●
Figures (Shift to upper case)		●	●		●	●
Space				●		
Carriage Return					●	
Line Feed			●			
Blank						

Presence of ● indicates marking impulse.
Absence of ● indicates spacing impulse.

section 2 / teletypewriter signals

Teletypewriter signals consist of groups of d-c impulses, much as Morse code characters consist of groups of dots and dashes. Each group represents an alphanumeric character or a function. Instead of dots and dashes, a Teletypewriter character is made up of a series of impulses, each of equal length. The impulses are referred to as marks and spaces, rather than dots and dashes as in the Morse code. They are transmitted in one of two forms: a neutral signal or a polar signal.

In a neutral circuit, the marking impulse occurs when the circuit is closed. That is, current (usually 60 ma) flows in the loop. The spacing impulse occurs when the circuit is open or no current is flowing.

In a polar circuit, current always flows, whether a space or mark is transmitted. Here, it is the direction of current flow that differentiates between the two. Loop current in a polar circuit (usually 35 ma) flows in one direction when marking and in the opposite direction when spacing.

Teletypewriter codes most often used are the 5-level and 8-level codes. The term, 5-level, indicates that five impulses are used in the representation of each character; 8-level indicates eight impulses per character. Of these two, the 5-level or Baudot code is more frequently used for communications purposes. It is shown in Table 1.

The signal that is actually transmitted by a 5-level machine includes two other impulses in addition to the five character impulses. These are the start and stop signals that accompany each character transmission. The start impulse precedes the first impulse of each character and is always a spacing impulse, and the stop impulse follows the last im-

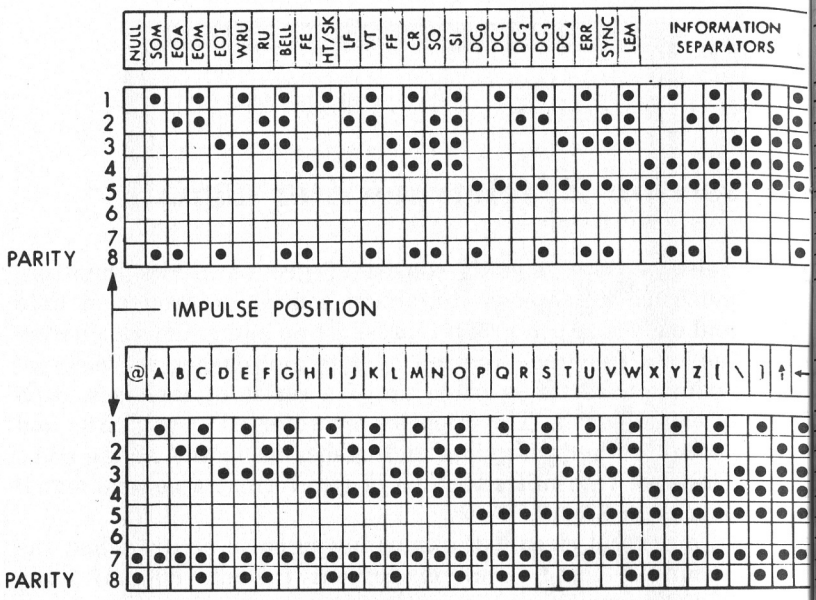
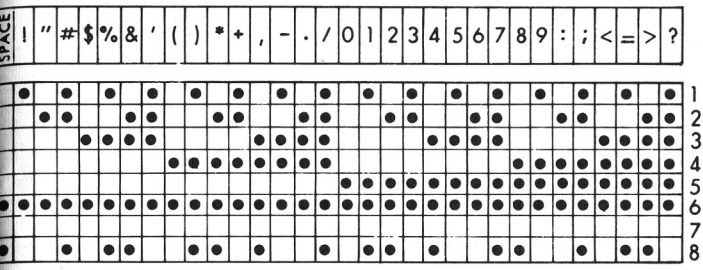
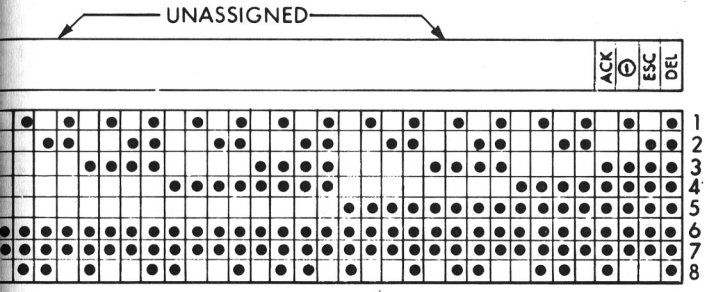


TABLE 2. ASCII 8-LEVEL CODE

pulse of each character and is always a marking impulse. The start impulse has the same duration as each of the character impulses, but the stop impulse has a duration 1.42 times that of the others. If each character impulse is given a unit time duration, the total time required to transmit any character is 7.42 units. For this reason, the Baudot code is frequently referred to as the 7.42-unit code. The time relationship of the impulses is illustrated in figure 2 using the letter Y as an example. The impulse durations are given for the most common operating speeds. The stop and start impulses will be discussed in more detail in later sections.

Until recently, the use of eight level codes was restricted mostly to data equipment and saw little use in teletypewriters. Eight level codes have the advantage of greater capacity over five level codes, being capable of a maximum





LEGEND

NULL	Null/Idle	**DC_1-DC_2**	Device control
SOM	Start of message	**DC_1 (Stop)**	Device control (stop)
EOA	End of address	**ERR**	Error
EOM	End of message	**SYNC**	Synchronous idle
EOT	End of transmission	**LEM**	Logical end of media
WRU	"Who are you?"	**S_0-S_1**	Separator (information)
RU	"Are you . . . ?"	**b**	Word separator (space, normally non-printing)
BELL	Audible signal	$<$	Less than
FE_0	Format effector	$>$	Greater than
HT	Horizontal tabulation	$\uparrow$	Up arrow (Exponentiation)
SK	Skip (punched card)	$\leftarrow$	Left arrow (Implies/ Replaced by)
LF	Line feed	$\backslash$	Reverse slant
V_{TAB}	Vertical tabulation	**ACK**	Acknowledge
FF	Form feed	①	Unassigned control
CR	Carriage return	**ESC**	Escape
SO	Shift out	**DEL**	Delete/Idle
SI	Shift in		
DC_0	Device control reserved for data link escape		

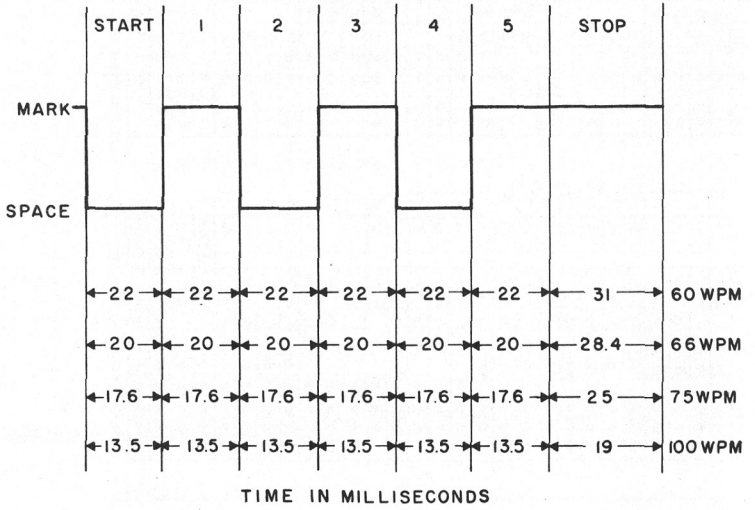


Figure 2. The 7.42 Unit Code Time Base
Using the Letter Y as an Example

of 2^8 characters, while only 2^5 characters are available using a five level code.

In 1963, industry adopted as an 8-level standard the American Standard Code for Information Interchange (ASCII). It is shown in Table 2. While it is an 8-level code, only seven of the eight impulse positions are used for character description. The eighth impulse may be used for parity. In teletypewriters the eighth impulse is marking if parity is not used.

Eight level teletypewriters are generally eleven unit code machines. In addition to the eight information bits, a one-unit start pulse (spacing) and a two-unit stop pulse (marking) is transmitted with each character.

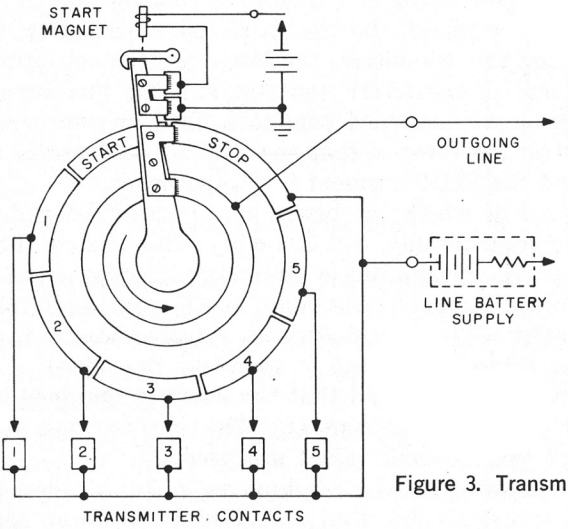


Figure 3. Transmitter-Distributor

section 3 | generation of signals

The device that generates teletypewriter signals is known as a transmitter-distributor. One of the oldest and most easily understood configuration of the transmitter-distributor is shown in figure 3. The transmitter contacts are connected mechanically to the keyboard. The brush arm is coupled to the motor in the machine through a friction clutch. Assume that the key for transmitting the letter Y is depressed. When this occurs, the mechanical connection from the keyboard to the transmitter contacts cause the number 1, 3, and 5 contacts to be connected electrically to their corresponding ring segments. At the same time, the start magnet is energized momentarily and the brush arm

begins its rotation. As the brush arm passes over the START segment, the line is open, or spacing. When passing over the 1 segment, the line is closed, or marking, and so on. After one revolution, the latch catches the brush arm at the end of the STOP segment and the line remains in the closed or mark-hold condition until another character is transmitted. Notice that the START segment is always open and the STOP segment is always closed.

The speed at which the brush arm rotates determines the speed of transmission. For 100-wpm transmission, the brush completes a revolution in 100 milliseconds; 130.6 milliseconds at 75 wpm; 148.4 msec at 66 wpm; and 163 msec at 60 wpm. A word is defined as 6.1 characters. However, if these figures are used to calculate the speed of transmission, it will be found that the answers obtained are not precisely 60 wpm, 66 wpm, etc. They are so close, however, that the approximate values are used.

Modern transmitter-distributors no longer employ the revolving brush configuration. Rather, they are an assembly of various levers, bails, and revolving cams which give the same results electrically but do so with more reliability and compactness.

section 4 | transmission of signals

The teletypewriter circuit depicted in figure 1 includes the end devices (the teletypewriters), two wires interconnecting the two, and a battery supply. This configuration, which provides one-way communications, is known as a simplex circuit. If there were two such circuits, with a transmitter and a receiver at each end to provide simultaneous two-way communications, it would be termed a full-duplex circuit.

Another means of obtaining two-way communications, but using only two interconnecting wires instead of four, is with a half-duplex circuit as illustrated in figure 4. Each Teletype station consists of a transmitter and receiver in

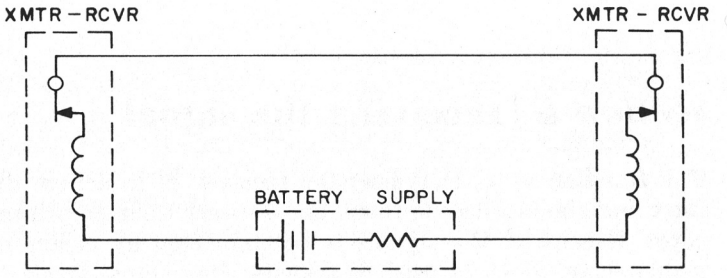


Figure 4. Half-Duplex Circuit

series. While both the half- and full-duplex circuits provide two-way communications, only the full-duplex circuit can be used for simultaneous two-way traffic. The half-duplex circuit may be used for both sending and receiving, but not at the same time.

Each of the circuits shown has included a battery supply as a source of signal power. This is necessary because the teletypewriter transmitter provides only timed contact closures — not a powered signal. While it is possible to include the signal power source in the machine, it is not standard practice to do so in neutral circuits. Battery usually is supplied with a teletypewriter line. The battery voltage is most often 130 volts d-c, although loop voltages twice that value are not uncommon. The appropriate resistance is inserted in series with the battery to limit the loop current as required. Neutral circuits usually operate at either 60 ma or 20 ma.

Polar circuits, more common in Europe than in this country, do require that the teletypewriter set contain its own line battery supply. This is because polar transmission requires the reversing of signal line current rather than the mere breaking of a circuit as in neutral operation. Each polar transmitter contains two battery supplies of opposite polarity. The transmitter contact switches back and forth between the two. Common values of polar loop currents are 35 ma and 20 ma.

section 5 / receiving the signal

The function of a teletypewriter receiver is to accept the incoming signals, decode them, and convert them to printed copy. Receipt of the signals is accomplished by means of a line relay which is used to transfer line signal levels to levels used in the teletypewriter.

To explain the decoding of the signals, reference will be made once again to an outmoded device, a receiving distributor, illustrated in figure 5. The selecting magnets shown in the figure are used to select the type pallet which corresponds to the character represented by the transmitted signal. The printing magnet, when activated, causes the selected pallet to print its character. To understand the receiver operation better, assume that the outgoing line, shown in figure 3, is connected to the incoming line of figure 5 and that the transmitter-distributor transmits the letter Y at a 100-wpm rate. Upon receipt of the start impulse, the line relay is de-energized causing the receiving start magnet to be energized. This allows the brush arm to rotate. After 13.5 milliseconds, the first character impulse is transmitted and the line is marking. During this period, the brush arm passes over the 1 segment and first selector magnet is energized. The second selector magnet is not energized because the second character impulse is a space, and no current flows as the brush passes over the 2 segment. As the brush continues its rotation, selector magnets 3 and 5 also are energized. Each of the selector magnets that is energized mechanically positions a code bar, and they, in turn, collectively select the type pallet Y and set it up for typing. Passing off of segment 5, the brush arm then applies power to the printing magnet which causes the type pallet to strike the paper and clear the code bars for the next character. The brush arm completes

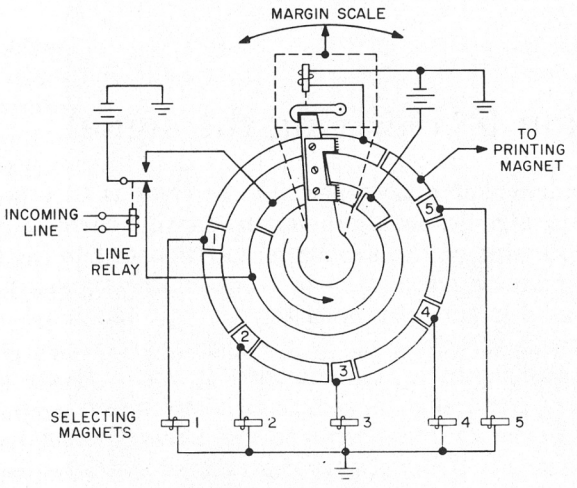


Figure 5. Receiving Distributor

its rotation as it is caught by the latch. The stop pulse causes the arm to remain latched until the next start pulse is received.

The segments in the transmitter-distributor each had an arc length of 360 degrees/7.42 (except for the STOP segment which was 1.42 longer). The segments in the receiving distributor, however, are much shorter, which means that only a small portion of the transmitted signal actually is "looked at" for decoding. The reason for this is that teletypewriter signals often are distorted as they travel on a line from transmitter to receiver, and the short receiving segments allow considerable distortion (or shortening) of the signal before it fails to recognize them. Teletypewriter receivers include in their design a device called the range finder. Its function is to allow the brush arm position to be moved about so that the arc length of the receiving segments may be "centered" on the incoming impulses. The operable range of the range finder is called the receiving margin.

By now, the manner in which start and stop impulses are used should be apparent. The reason for their use is as follows: As timed impulses are used to carry information from the transmitter to the receiver, it is imperative that the two machines be synchronized. Reasonable synchronization may be obtained using governed motors, or by synchronous motors powered by stable a-c sources. Even under these conditions, however, small differences in rotational speed will inevitably occur and soon result in the loss of synchronization. For this reason, the rotation of the transmitting and sending distributors is started for each character and stopped thereafter. Obviously, a relatively severe difference in motor speeds must occur before communications break down when using the start-stop method, because the difference error is cumulative only for the time required to transmit one character.

Once again, it should be pointed out that the receiving distributor, as described in this section, is not used in modern teletypewriters; it was used as an example here because it is easily understood. The principles it employs, however, are unchanged even in modern teletypewriter receivers which utilize more sophisticated electromechanical features to accomplish the same end result.

section 6 / teletypewriter distortion

The lines used to carry teletypewriter signals contain a certain degree of distributed inductance, capacitance, and resistance. Their effect is to distort the square impulse that was transmitted.

Figure 6 shows both an undistorted and a distorted impulse. The dots on the wave indicate line relay pull-in and dropout points. It can be seen from the illustration that the relay is not pulled in for as long a period when driven by a distorted signal. The effect of distortion, then, is that the received impulses are of a different length from those which were transmitted and are displaced in time.

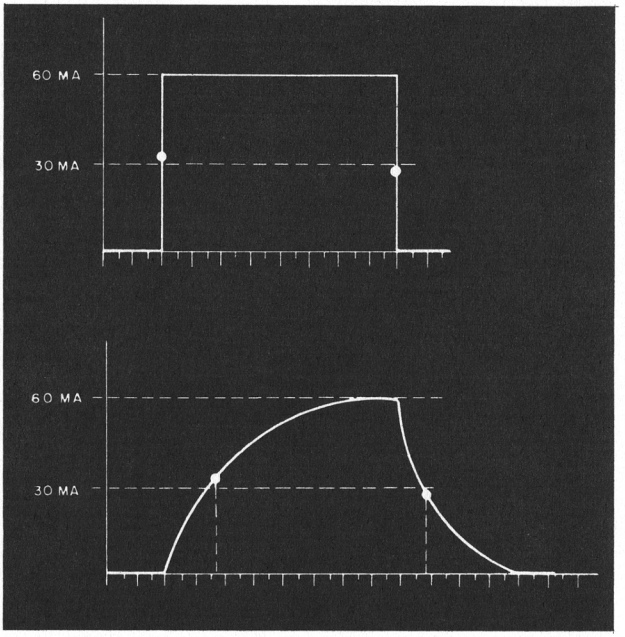
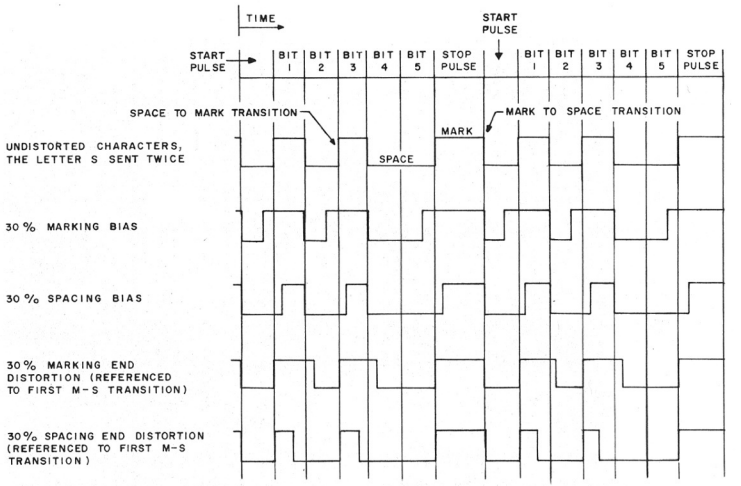


Figure 6. Undistorted and Distorted Impulse

Since distortion affects the time interval during which the signal line is switching, that is, the time during which the line is changing from a mark-to-space or a space-to-mark condition, the type of distortion introduced is defined by the switch or transition affected. Bias distortion is defined as distortion which displaces the space-to-mark transition. End distortion displaces the mark-to-space transition. The various types of distortion are illustrated and explained in figure 7. Square impulses were used in the illustration to emphasize how the particular transition is modified under various conditions of distortion. In reality, a distorted signal is more closely depicted in figure 6.



NOTES:
1. BIAS DISTORTION DISPLACES THE SPACE-TO-MARK TRANSITION
   A. MARKING BIAS ADVANCES THE TRANSITION (LENGTHENS THE MARK)
   B. SPACING BIAS DELAYS THE TRANSITION (LENGTHENS THE SPACE)
2. END DISTORTION DISPLACES THE MARK-TO-SPACE TRANSITION
   A. MARKING END DELAYS THE TRANSITION (LONG MARK)
   B. SPACING END ADVANCES THE TRANSITION (LONG SPACE)
3. FORTUITOUS AND CHARACTERISTIC DISTORTION MAY DISPLACE BOTH TRANSITIONS

Figure 7. Teletypewriter Distortion

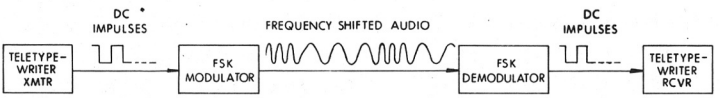


Figure 8. Simplified FSK Teletypewriter System

section 7 / FSK and RTTY

As indicated in Section 4 and the succeeding sections, teletypewriter signals are generally carried over hard wire circuits in the form of dc current impulses. However, in some applications where teletypewriter communications is required, other factors make dc signalling means impractical. It may be desirable, for example, to use a voice telephone line for teletypewriter data transfer. In another instance, air-to-ground teletypewriter communications may be required. In either case, the ordinary dc loop would not be suitable.

Teletypewriter communications with ac signalling is accomplished by a system known as Frequency Shift Keying (FSK). It involves the use of an FSK modulator which converts teletypewriter dc impulses into audio tones. A simplified diagram of such a system is shown in figure 8. When transmitting FSK, an audio tone is generated whose frequency depends on whether a mark or a space is transmitted. The frequency differential between a mark and space condition is usually around 100 cps. At the receiving end, an FSK demodulator converts the tones back to dc impulses which, in turn, operate the teletypewriter.

Radioteletype (RTTY) is a means of providing teletypewriter communications via radio link rather than hard wire. An RTTY system utilizes the dc impulses from the teletypewriter to modulate a radio transmitter. At the receiving end, the radio waves are demodulated and converted to dc impulses which operate a teletypewriter receiver. Figure 9 is a simplified diagram of an RTTY system.

The two most frequently used types of modulation in RTTY are FSK and AM. As discussed previously, FSK involves

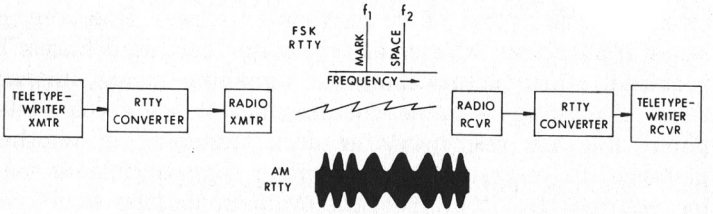


Figure 9. Simplified RTTY System

the shifting of frequency to differentiate between marks and spaces. The principle is the same in RTTY, the primary difference being the operating frequency. Before, it was in the audio range; here the r-f carrier frequency is shifted. The shift frequency is generally greater too, ranging up to 900 cps.

The use of amplitude modulation in RTTY is less common than FSK and is generally restricted to the VHF bands. It involves simply the amplitude modulation of a carrier frequency. One frequency of modulating tone is used for marks, and a different modulating tone for spaces. The tone frequencies are in the audio range, generally 2-3 kcs.

section 8

varieties of teletype machines

The teletypewriter transmitters and receivers discussed previously are available in a number of different configurations. The most widely used of those are listed along with a description of their features. Photographs of some of these machines are shown in figures 10 through 21.

Receive-only page printer

Commonly referred to as an RO. It is a receiver which produces page copy as its readout.

Keyboard send-receive set

Commonly referred to as a KSR. It is basically an RO but includes a keyboard for manual sending capability.

Receive-only typing reperforator

Commonly referred to as an ROTR or, phonetically, a Rotor. It is a receiver whose readout is in the form of perforated paper tape. The code representation of each received character is punched into the tape and, in addition, the received characters are printed along the edge of the tape. It is used in applications where the received message is to be retransmitted. To accomplish this, the received tape is simply fed into a tape transmitter.

Tape transmitter

Commonly referred to as a transmitter-distributor or TD. It is a device which accepts punched paper tape as an input and transmits the information which is on the tape.

Automatic send-receive set

Commonly referred to as an ASR. It is a half-duplex device containing both transmitter and receiver. The readout is in the form of printed page copy. A keyboard is included and has two functions: It can be used for keyboard transmission or it can be used to punch paper tape manually. An ASR set also includes a perforator (paper tape punch) which is connected mechanically to the keyboard. The operator may punch up a tape from the keyboard without affecting the Teletype line, then transmit the information impressed on the tape with the TD, which is also a part of the ASR.

Reperforator transmitter

Commonly referred to as an RT set. It contains a typing reperforator, paper tape storage facilities, and a tape transmitter. It is used primarily as a relaying device. The typing reperforator is connected to an incoming line and the TD to an outgoing line. An incoming message is punched on tape, which usually is stored until the message has been received in its entirety, and then is retransmitted by the TD. The incoming and outgoing speeds need not be the same.

Paper tape printer

A receiver whose readout is in the form of printed, but not punched, paper tape. It is sometimes equipped with a keyboard for manual sending. Its primary use is in line monitoring applications where it is desirable to verify the receipt of all the characters that were transmitted, including function characters that don't appear on page copy such as figures shift (↑), letters shift (↓), carriage return (<), line feed (≡), etc.

The most widely-accepted line of equipment in use today is the Teletype Corporation Model 28 series. All of the

Figure 10. M28 Receive Only Page Printer (RO). A teletypewriter receiver whose readout is in the form of printed page copy.

Figure 11. M28 Keyboard Send-Receive Set (KSR). A transmitter-receiver consisting of an RO with keyboard for manual sending.

previously listed machines are available in the M28 line. They are 5-level machines that became available approximately ten years ago. A new line of 5-level machines being marketed currently is the Model 34 series. Internally it is essentially the same as the M28, but the exterior has been modernized. The Model 32 line is still another 5-level series, but M32 machines are lightweight, light duty machines for use in locations where they will not be operated continually.

The Model 29, 33, and 35 series are all similar in appearance to the Model 28, 32, and 34 series respectively, but the former are 8-level machines.

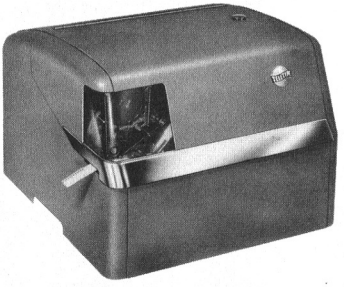


Figure 12. M28 Receive Only Typing Reperforator (ROTR). A receiver whose readout is in the form of punched paper tape. The received characters are also typed along the edge of the tape.

Figure 13. M28 Automatic Send-Receive Set (ASR). A half-duplex teletypewriter station which contains a page printer, keyboard, tape punch and tape reader.

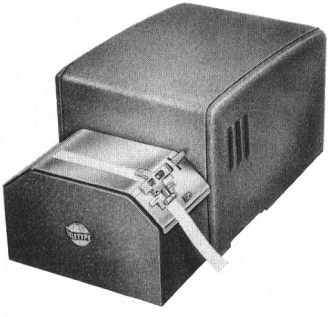


Figure 14. M28 Tape Transmitter (TD). A paper tape reader.

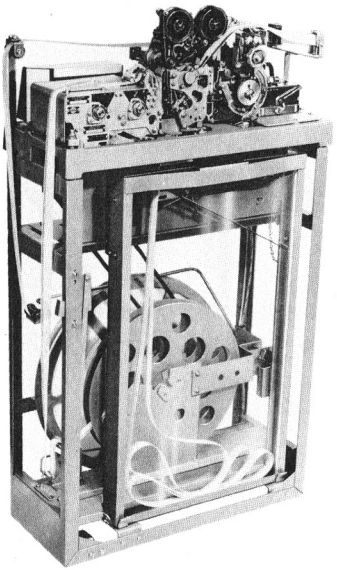


Figure 15. M28 Reperforator Transmitter (RT). An ROTR with paper tape storage facilities for buffering, and a paper tape reader for re-transmitting.

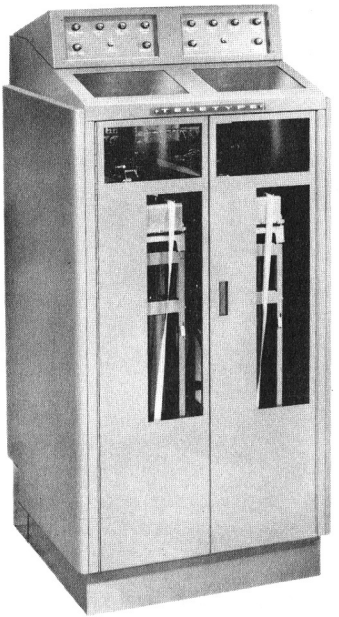


Figure 16. M28 Reperforator Transmitters (Two in One Cabinet)

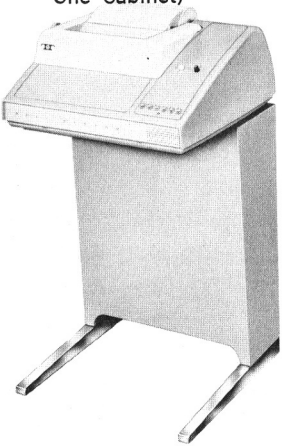


Figure 17. M33 Receive Only Page Printer. A standard duty, 8-level RO.

Figure 18. M33 Automatic Send-Receive Set. A standard duty 8-level ASR.

Figure 19. M35 Keyboard Send-Receive Set. Heavy duty eight level KSR.

Figure 20. M35 Automatic Send-Receive Set. Heavy duty eight level ASR.

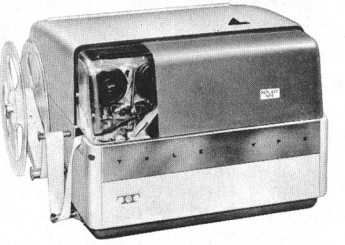


Figure 21. M35 Receive-Only Typing Reperforator. An 8-level paper tape receiver.

section 9

glossary of teletypewriter terms

Alphanumerics Characters which may be either letters of the alphabet or numbers.

ASR Automatic send-receive set. A combination teletypewriter transmitter and receiver with transmission capability from either keyboard or paper tape. Most often used in a half-duplex circuit.

Baud Bit per second, or the inverse of the length of one impulse.

Baudot Code A 5-level teletypewriter code consisting of a start impulse and five character impulses, all of equal length, and a stop impulse whose length is 1.42 times that of the start impulse. Also known as the 7.42 unit code.

Bias Distortion A form of teletypewriter distortion which displaces the space-to-mark transition.

Bit One impulse, or the time interval normally occupied by one impulse.

CDC Call directing code. An identifying call, usually two letters, which is transmitted to an outlying teletypewriter receiver and automatically turns its printer on (selective calling).

Chad The paper waste resulting from tape being punched.

Chadless tape Perforated paper tape in which the perforations are only partial to eliminate the problem of chad accumulation.

Characteristic Distortion A form of teletypewriter distortion which results in the impulses being either shortened or lengthened. It is a fixed distortion which generally does not change in degree from day to day.

Distortion The effect on a teletypewriter signal caused by distributed inductance, capacitance, and resistance in a line; unbalanced voltages; ground potentials; improper relay bias and adjustment; and other causes.

Eight Level Any teletypewriter code which utilizes eight impulses, in addition to the start and stop impulses, for describing a character.

End Distortion A form of teletypewriter distortion which displaces the mark-to-space transition.

FDX Abbreviation for full-duplex.

Figures Shift A function performed by a teletypewriter, when initiated by the figures shift character, which causes the machine to shift to upper case for numbers, symbols, etc.

Five Level Any teletypewriter code which utilizes five impulses, in addition to the start and stop impulses, for describing a character.

Fortuitous Distortion A type of teletypewriter distortion which results in the impulses being either shortened or lengthened. It is an intermittent distortion caused by battery fluctuations, hits on the line, power induction, etc.

Fox Message A standard message which is used for testing teletypewriter circuits and machines because it includes all the alphanumerics on a teletypewriter as well as most of the function characters such as space, figures shift, letters shift, etc. It is: THE QUICK BROWN FOX JUMPED OVER A LAZY DOG'S BACK 1234567890 --- SENDING. The sending station's identification is inserted in the three blank spaces which precede the word SENDING.

FSK Frequency Shift Keying. A method of teletypewriter transmission using ac signalling.

Full-Duplex A four-wire teletypewriter circuit which will facilitate simultaneous two-way communications.

Fully Perforated Tape Perforated paper tape in which the perforations are complete. That is, the punch makes a complete hole in the tape (as opposed to chadless tape where the hole is not completely punched out).

Half-Duplex A two-wire teletypewriter circuit which will facilitate two-way communications, but not simultaneously.

HDX Abbreviation for half-duplex.

Hit on the Line A momentary open circuit on a teletypewriter loop.

KSR Keyboard send-receive set. A combination teletypewriter transmitter and receiver with transmission capability from keyboard only.

Letters Shift A function performed by a teletypewriter, when initiated by the letters shift character, which causes the machine to shift from upper case to lower case.

Loop A teletypewriter circuit.

Mark An impulse which, in a neutral circuit, causes the loop to be closed; or in a polar circuit, causes the loop current to flow in a direction opposite to that for a space impulse.

Marking End Distortion End distortion which lengthens the marking impulse by delaying the mark-to-space transition.

Mark-Hold The normal no-traffic line condition whereby a steady mark is transmitted.

Marking Bias Bias distortion which lengthens the marking impulse by advancing the space-to-mark transition.

Mark-to-Space Transition The transition, or switching, from a marking impulse to a spacing impulse.

Neutral Circuit A teletypewriter circuit in which current flows in only one direction. The circuit is closed during the marking condition and open during the spacing condition.

Off-Line Not in the loop. Paper tapes frequently are punched "off-line" on an ASR and then transmitted using the TD.

On-Line In the loop.

Perforator A paper tape punch which is controlled mechanically. It is used for punching tape off-line.

Polar Circuit A teletypewriter circuit in which current flows in one direction on a marking impulse and in the opposite direction during a spacing impulse.

Range Receiving margin of a teletypewriter receiver.

Range Finder An adjustable mechanism on a teletypewriter receiver which allows the receiver-distributor face to be moved through an arc corresponding to the length of a unit segment. It is adjusted normally for best results under operating line conditions.

Receiving Margin Sometimes referred to as range or operating range. The usable range over which the range finder may be adjusted. The normal range for a properly adjusted machine is approximately 75 points on a 120-point scale.

Reperforator A paper tape punch which is controlled electrically. It is used for punching tape on-line. Reperforators, when installed in ASR's, may be used as perforators for manually punching tape, as well as for producing a tape from on-line traffic.

RO Receive Only. A receive only page printer.

Rotor Phonetic term for ROTR.

ROTR Receive Only Typing Reperforator. A teletypewriter receiver which produces perforated tape with characters typed along the edge of the tape.

RT Reperforator Transmitter. A teletypewriter receiver-transmitter consisting of a reperforator and a tape distributor, each of which is independent of the other. It is used as a relaying device and is especially suitable for transforming the incoming speed to a different outgoing speed.

RTTY Radio telecommunications. A method of teletypewriter communication using a radio link.

Running Open Term used to describe a machine connected to an open line or a line without battery. A teletypewriter receiver under such a condition appears to be running, as the type hammer continually strikes the type box but does not move across the page.

Selective Calling A form of teletypewriter communications system. One teletypewriter loop may include several machines but, with selective calling, only the machine selected will respond. The device that controls the individual machines in response to a selective call (CDC) is called a stunt box.

Simplex A two-wire teletypewriter circuit which will facilitate one-way communications.

Space An impulse, which in a neutral circuit, causes the loop to open; or in a polar circuit, causes the loop current to flow in a direction opposite to that for a mark impulse.

Spacing Bias Bias distortion which lengthens the spacing impulse by delaying the space-to-mark transition.

Spacing End Distortion End distortion which lengthens the spacing impulse by advancing the mark-to-space transition.

Space-to-Mark Transition The transition, or switching, from a spacing impulse to a marking impulse.

Stunt Box A device used in teletypewriters to perform nonreadout functions such as carriage return, line feed, ring signal bell, answer CDC's and TSC's, etc.

TSC Transmitter Start Code. Usually a two-letter call that is sent to an outlying teletypewriter which automatically turns its tape transmitter on.

TD Transmitter-Distributor. The device in a teletypewriter which makes and breaks the line in timed sequence. Modern usage of the term refers to a paper tape transmitter.

Transition A change in state of a teletypewriter line. The act of a line going from a marking state to a spacing state, or vice versa, is known as a transition.

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